



Major vectors and vector-borne diseases in small ruminants in Ethiopia: A systematic review



Kassahun Asmare^{a,*}, Takele Abayneh^b, Berhanu Sibhat^c, Dessie Shiferaw^a, Barbara Szonyi^d, Randi I Krontveit^e, Eystein Skjerve^f, Barbara Wieland^d

^a School of Veterinary Medicine, Hawassa University, P.O. Box 005, Hawassa, Ethiopia

^b College of Veterinary Medicine and Agriculture, Addis Ababa University, P.O. Box 34, Debre-Zeit, Ethiopia

^c College of Veterinary Medicine, Haramaya University, P.O. Box 138, Dire Dawa, Ethiopia

^d International Livestock Research Institute (ILRI), P.O. Box 5689, Addis Ababa, Ethiopia

^e Norwegian Medicines Agency, P. O. Box 6167 Etterstad, N-0602, Oslo, Norway

^f University of Life Sciences, Department of Food Safety and Infection Biology, Oslo, Norway

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ABSTRACT

Vector-borne diseases are among major health constraints of small ruminant in Ethiopia. While various studies on single vector-borne diseases or presence of vectors have been conducted, no summarized evidence is available on the occurrence of these diseases and the related vectors. This systematic literature review provides a comprehensive summary on major vectors and vector-borne diseases in small ruminants in Ethiopia. Search for published and unpublished literature was conducted between 8th of January and 25th of June 2015. The search was both manual and electronic. The databases used in electronic search were PubMed, Web of Science, CAB Direct and AJOL. For most of the vector-borne diseases, the summary was limited to narrative synthesis due to lack of sufficient data. Meta-analysis was computed for trypanosomosis and dermatophilosis while meta-regression and sensitivity analysis was done only for trypanosomosis due to lack of sufficient reports on dermatophilosis. Owing emphasis to their vector role, ticks and flies were summarized narratively at genera/species level. In line with inclusion criteria, out of 106 initially identified research reports 43 peer-reviewed articles passed the quality assessment. Data on 7 vector-borne diseases were extracted at species and region level from each source. Accordingly, the pooled prevalence estimate of trypanosomosis was 3.7% with 95% confidence interval (CI) 2.8, 4.9), while that of dermatophilosis was 3.1% (95% CI: 1.6, 6.0). The in-between study variance noted for trypanosomosis was statistically significant ($p < 0.05$). Among the three covariates considered for meta-regression, only one (species) fitted the final model significantly ($p < 0.05$) and explained 65.44% of the between studies variance (R^2). The prevalence in sheep (5.5%) increased nearly by 34% compared to goats (2.9%). The parasitic presence in blood was documented for babesiosis (3.7% in goats); and anaplasmosis (3.9% in sheep). Serological evidence was retrieved for bluetongue ranging from 34.1% to 46.67% in sheep, and coxiellosis was 10.4% in goats. There was also molecular evidence on the presence of theileriosis in sheep (93%, $n = 160$) and goats (1.9%, $n = 265$). Regarding vectors of veterinary importance, 14 species of ticks in five genera, four species of *Glossina* and 4 genera of biting flies were reported. Despite the evidence on presence of various vectors including ticks, flies, mosquitoes and midges, studies on vector-borne diseases in Ethiopia are surprisingly rare, especially considering risks related to climate change, which is likely to affect distribution of vectors. Thus better evidence on the current situation is urgently needed in order to prevent spread and to model future distribution scenarios.

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* Corresponding author.

E-mail address: kassahun7588@gmail.com (K. Asmare).

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1. Introduction

Vector-borne diseases like trypanosomosis, East Coast Fever (ECF), piroplasmosis, ehrlichiosis, dermatophilosis and Rift Valley Fever (RVF) are among the well documented diseases in Sub-Saharan Africa to reduce productive and reproductive performance of small ruminants (Swallow 1999; Taylor et al., 2007). A range of arthropod vectors *i.e.* flies for trypanosomosis, mosquito and midge particularly, *Aedes mcintoshi* and *Culicoides immicola*, are associated with viral diseases such as Rift Valley Fever and bluetongue, respectively. Ticks, the other important category of arthropod vectors, are responsible for large number of diseases caused by piroplasm, *Rickettsia*, bacterial and viral infections (Taylor et al., 2007). These days the aforesaid vectors and associated infectious agents are taking unprecedented spatial and temporal pasterns and are becoming an increasing problem worldwide due to climate change resulting in increased environmental temperature and shifts in rainfall patterns (Githeko et al., 2000; Purse et al., 2005).

In Ethiopia the presence of several vectors of veterinary importance, particularly ticks and flies, have been documented (Dinka and Abebe, 2005; Sinishaw et al., 2006; Abera et al., 2010; Chanie et al., 2010; Abebe et al., 2011; Kumsa et al., 2012; Tesfaye et al., 2012). It is also common to hear about the vector-borne diseases as part of major health challenge in the animal health service delivery (MoA, 2012). However, limited research evidences are available on specific diseases transmitted by the mentioned vectors in small ruminants. The few available reports focus on trypanosomosis (Dinka and Abebe, 2005; Leta and Mesele, 2010) bluetongue (Woldemeskel et al., 2000; Gulima, 2009), theileriosis (Gebrekidan et al., 2014), coxiellosis (Gumi et al., 2013), babesiosis, anaplasmosis (Sitotaw et al., 2014) and dermatophilosis (Woldemeskel and Mersha, 2010).

Indeed, the diseases mentioned differ in terms of etiological agents and associated biology, clinical feature and pathology. Nevertheless, they share important epidemiological features in that they are all vector-borne, and thus have seasonal dynamics and probably show spatial patterns that could give an opportunity for introducing comprehensive control strategies. Therefore, systematic investigation of the research evidences on the diseases in

question and their associated vectors will give opportunity to visualize the extent of the studies made and identify gaps that need to be addressed. Pursuant to this, livestock policy experts and fellow researchers will use the finding to craft the way forward accordingly. To authors knowledge however, no such compiled evidence is available so far to serve the intended purpose. Hence the present study aimed at summarizing the available research reports on each disease and produce a review that contributes to the current understanding of vectors, vector-borne diseases status and level of investigations in small ruminants in Ethiopia.

2. Materials and methods

2.1. Review protocol

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (Moher et al., 2009) were used to develop the roadmap of the review. This includes a template for literature search with predefined inclusion and exclusion criteria, as well as a quality assessment format and data extraction template.

2.2. Literature search

Literature written in English or Amharic languages which were either published in peer reviewed journals or as grey literature was retrieved electronically or manually. For the electronic search, PubMed, Web of Science, Cab direct and African Journals Online (AJOL) were the databases used. The key words used in electronic search were small ruminants, sheep, goats, ticks, midge, mosquito, biting flies, tsetse fly, *Glossina*, vector-borne diseases, tick-borne diseases, trypanosomosis, babesiosis, anaplasmosis, ehrlichiosis, dermatophilosis, theileriosis, bluetongue, coxiellosis, Rift valley fever, and Ethiopia. The key words were re-arranged to reflect as close as possible to vectors and vector-borne diseases of small ruminants in Ethiopia. Moreover; unpublished manuscripts were searched at the veterinary faculties of Addis Ababa, Haramaya, Jimma, Gondar and Hawassa universities, and repositories of the International Livestock Research Institute and the Ethiopian Vet-

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